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Correct solution. Let the highest common divisor of  $x$  and  $x+a$  be  $m$ . Then evidently the solution is

$$\begin{aligned}x &= mr^2 \dots (1), \\ x+a &= ms^2 \dots (2), \\ y &= mrs \dots (3).\end{aligned}$$

From (1) and (2),  $a = m(s^2 - r^2)$ .

Then if  $a$  is given, we can put  $s^2 - r^2$  equal to the different factors of  $a$ , and  $m$  equal to the remaining factor.  $s^2 - r^2$  may be put equal to any factor of  $a$  excepting the double of an odd number.

Example.  $a=15$ . If  $a^2 - r^2 = 15$ ,  $s+r=15$  or  $5$ ,  $s-r=1$  or  $3$ ,

$$\left. \begin{matrix} s=8 \\ r=7 \end{matrix} \right\} \text{ or } \left. \begin{matrix} s=4 \\ r=1 \end{matrix} \right\}, m=1.$$

These give  $x=49$ ,  $y=56$ ,  $x=1$ ,  $y=4$ .

This last solution is omitted in Professor Griffin's table owing to his incorrect analysis.

If  $s^2 - r^2 = 5$ ,  $m=3$ ,  $x=12$ ,  $y=18$ .

If  $s^2 - r^2 = 3$ ,  $m=5$ ,  $x=5$ ,  $y=10$ .

179. Proposed by V. M. SPUNAR, Chicago, Ill.

Solve the equation in integers,  $x^n + y^n + z^n + xyz = 100x + 10y + z$ .

Solution by A. H. HOLMES, Brunswick, Maine.

Put  $xyz=100x$ .  $\therefore yz=100$ , and  $z=100/y$ .

$$\therefore x^n + y^n + \frac{100^n}{y^n} = 10y + \frac{100}{y}; \text{ or } x^n = 10y + \frac{100}{y} - y^n - \frac{100^n}{y^n}.$$

For  $n$  even,  $10y + \frac{100}{y} > y^n + \frac{100^n}{y^n}$ .

Put  $n=2$ . Then  $10y + \frac{100}{y} > y^2 + \frac{10000}{y^2}$ .

But  $y = \frac{100}{z} = 1, 2, 4, 5, 10, 20, 25, 50$ , or  $100$ .  $\therefore n=1$  and  $x=9y$ .

$$\therefore n=1: \begin{cases} x=9, 18, 36, 45, 90, 180, 225, 450, 900. \\ y=1, 2, 4, 5, 10, 20, 25, 50, 100. \\ z=100, 50, 25, 20, 10, 5, 4, 2, 1. \end{cases}$$

Put  $xyz=10y$ .  $\therefore xz=10$ ,  $z=\frac{10}{x}$  and  $x^n + y^n + \frac{10^n}{x^n} = 100x + \frac{10}{x}$  or  $y^n =$

$$100x + \frac{10}{x} - x^n - \frac{10^n}{x^n}.$$

Put  $n=1$ . Then  $y=99x$ . But  $x=10/z=1, 2, 5, 10$ .

$$\therefore n=1 : \begin{cases} x=1, 2, 5, 10, \\ y=99, 198, 495, 990. \\ z=10, 5, 2, 1. \end{cases}$$

Put  $n=2$ . Then  $y^2=100x+10/x-x^2-100/x^2$ .  $\therefore x=1$  and  $10$ .

$$\therefore n=2 : \begin{cases} x=1, 10. \\ y=3, 30. \\ z=10, 1. \end{cases}$$

In neither case, when  $y=1, 2, 4, 5, 10, 20, 25, 50, 100$ , and  $x=1, 2, 5, 10$ , can  $n=3$ .

180. Proposed by A. H. HOLMES, Brunswick, Maine.

Find integral values for  $x$  and  $y$  in the following:  $96x-96y+21=\square$ .

Solution by the PROPOSER.

If we solve the equation

$$(1) \quad (24y+z)^2=25(24x+z-1),$$

for  $z$  we find

$$z = \frac{25-48y \pm 5\sqrt{(96x-96y+21)}}{2}.$$

Since the coefficient of  $z^2$  in (1) is unity, if for a pair of values of  $x$  and  $y$ ,  $96x-96y+21$  is a square, the corresponding value of  $z$  must be a rational integer. But no set of integral rational values of  $x$ ,  $y$ ,  $z$  will satisfy (1), for if the value of  $z$  is odd, the left hand member of (1) is odd and the right hand member is even, and vice versa for  $z$  even. Hence there are no integral values for  $x$  and  $y$  such that the given expression is a square.

☞ Problems and solutions for this department should be sent to Dr. Wahlin, Urbana, Ill.

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## PROBLEMS FOR SOLUTION.

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### ALGEBRA.

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353. Proposed by DANIEL KRETH, Oxford, Iowa.

Divide 2940 into two such factors that the square of one factor minus 21 will equal three times the other factor.

354. Proposed by THEODORE L. DeLAND, Treasury Department, Washington, D. C.

To find  $x$  in the following equation:

$$0.002\{6x-20[(1.05)^x-1]\}=0.012\{21[(1.05)^{x-1}-1]-(x-1)\}.$$